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Investigation of Reported Cancers in Workers and Air Quality Concerns 6th Floor, King County Administration Building

Prepared at the request of the King County Executive's Office by:

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Review Protocol and Acknowledgements

The special circumstances of this investigation—King County executive agencies investigating employee concerns about a potential cancer cluster and air quality at a King County workplace—suggested the need for additional outside review. To address potential concerns about conflict of interest, we arranged for review from colleagues at other agencies: the Washington State Department of Health (DOH) and the Washington State Department of Labor and Industries (L&I). The reviewers were Juliet VanEenwyk, PhD, State Epidemiologist for Non-infectious Conditions, DOH, and Martin Cohen, ScD, CIH, Industrial Hygienist and exposure assessment expert at the Safety & Health Assessment & Research for Prevention (the SHARP program) at L&I. We would like to thank to these individuals for their time and comments.

We would like to acknowledge Kathryn Golub, Washington State Cancer Registry and Teresa Sobol (and her staff), Human Resources Manager at the Office of Finance and Business Operations, for providing critical data for this report.

We also would like to thank the concerned employees for the critical information they have provided and their patience in awaiting the report's conclusion.

This report received input and review from Paul Tanaka of the County Executive's office, and Dr. Alonzo Plough, Director of Public Health. It also received legal review by Public Health for compliance with new regulations related to HIPAA and by John Zeldenrust, Deputy Prosecuting Attorney in the King County Prosecuting Attorney's Office.

SUMMARY

Introduction

In late July 2003, e-mail correspondence from an employee to the County Executive expressed concern about cancer occurrence on the 6th floor of the King County Administration Building, 500 Fourth Avenue, Seattle. The Executive's Office requested a data- and evidence-based evaluation by Public Health – Seattle & King County and King County Safety and Claims Management.

Jain Rutherford of Safety and Claims and David Solet of Public Health met with employees concerned about their workplace. The employees provided a list of people with cancer and identified asbestos and diesel exhaust as workplace environmental concerns. We have evaluated the cancer patterns, reviewed indoor air monitoring for asbestos to date, and conducted air sampling for diesel exhaust.

People with Cancer

To evaluate whether the pattern of people with cancer was unusual, we answered the following questions:

- Were the types of cancers in people unusual or unexpected? Because cancer is a collection of many different kinds of diseases with different causes, a cluster of one particular type (for instance, brain cancer or leukemia) heightens our concern for a common cause or environmental agent. (See Table 1 for the types of reported cancers and their known or suspected causes.)
- Did more people get cancer in a particular time period? We expect to see cancer occurrences spread out fairly evenly over time if they are not related to a period of high exposure.
- Was the age and gender of the people with cancer unusual? For instance, were there more than expected cancers in younger people, or in men or women?
- Was the total number of people with cancer more than would be expected in the 6th floor population, given its age and gender makeup?

Of the 18 people reported by concerned employees to have had cancer, 14 worked on the 6th floor. This report is focused on cancer in these 14 people. Cancer types and demographics were confirmed when possible from the Washington State Cancer Registry, death certificates and personnel records; information about three of the people with cancer was based on information from co-workers.

- Cancer Type (Figure 1)*:* The 14 people had at least eight different types of cancer. Three people had lung cancers; three had breast cancer, two had liver cancer, and one each had leukemia or cancer of the ovary, stomach, thyroid or uterus. The type of cancer for one person could not be determined. There was not a clustering of a particular cancer type.
- Time period (Figure 2): Thirteen of the cancers in people who worked on the 6th floor occurred between 1983 and 2003. The year of occurrence in one person with cancer could not be determined. Two cancers occurred in 2000 and 2003. The other years in which cancer occurred showed one person each. This pattern did not suggest a clustering in time.
- Age (Figure 3) and Gender: Age at diagnosis (or death, if age at diagnosis was not available) ranged from 53 to 67 years. The age for two people with cancer was not known. The average age was 60.0 years. Over half of the people with cancer were between 55 and 64 years old at diagnosis or death (Figure 3). This is consistent with the age-related increases in cancer risk

seen in the general population. Twelve cancers (86%) occurred in females; two (14%) occurred in males. The proportion of men and women in the people with cancer was not statistically significantly different than the distribution of gender in the 6th floor population.

- Total Cancer Incidence (Figure 4): We used the number of people reported with cancer on the 6th floor that occurred in the last five years, from 1999 through 2003, because it is more likely that people with cancer in more recent years were noted, remembered and reported. From 1999 to 2003, 7 cancers were observed, while 3.2 were expected (Figure 4). This was not a statistically significant difference (i.e, the difference between the number of observed and expected cancers may be due to chance or random variation alone).

Review of Indoor Air Sampling Results

The King County Safety and Claims Management group has data from 26 air quality testing reports for the Administration Building during the past ten years. These reports include information concerning carbon dioxide, temperature, relative humidity, hydrocarbons, mold spores, dust, asbestos, and carbon monoxide. None of the reports indicate any significant problems with the building's air quality. No air quality problems that can be related to cancer have ever been identified.

In addition, we have seven asbestos testing reports conducted in 2003 by the King County Facilities Management Division and outside contractors. None of the tests revealed asbestos levels in air above allowable limits. Sixty-three additional reports for asbestos testing between 1997 and 2002 also show no elevated asbestos levels in situations where office employees could be exposed. A summary of the asbestos area sampling information is attached to this document.

In order to address concerns about diesel exhaust, air monitoring specifically for diesel exhaust particulate was conducted on January 26 and 27, 2004. No diesel particulate was detected in the samples taken inside the building, and very low levels were found outside the building near the air intakes. A full summary of the monitoring results is attached to this report.

Conclusions

In summary, several factors tended to lower our concern that a common environmental toxic agent was causing cancer in employees: (1) The age, gender and total number of people with cancer was within expected limits; (2) There were several different types of cancer and the mix of types was not unusual and (3) The scientific literature does not point to a single environmental exposure that could cause these diverse types of cancers. Our review of indoor air quality data found no evidence of increased cancer risk from workplace exposures.

Unfortunately, cancer clusters occur regularly and are reported across a wide array of conditions, while causes are found only rarely. Cancer is also more common than many people realize. One in three Americans will get cancer in their lifetimes, and cancer will affect three out of four families. It is reasonable that employees will have questions about cancer and potential toxic exposures in the workplace, and we hope we have provided information that will be useful.

FULL REPORT

I. Cancer

Data Collection

Jain Rutherford, an industrial hygienist with Safety and Claims Management, and David Solet, a Public Health epidemiologist, met with concerned employees on August 6, 2003, to discuss their concerns. At our initial meeting, the employees gave us a list of people who had worked on the 6th floor (and, in some cases, on other floors) who had had cancer. In December 2003, an additional person recently diagnosed with cancer was reported, and is included in this analysis.

To better understand the pattern of cancer among employees, we checked several sources of information to verify the reports and obtain additional information.

- We used County personnel records to obtain identifying information to allow us to match people reported with cancer to state records for cancer and death, and for information on how long the person with cancer had worked on the 6th floor until they were diagnosed.
- We then tried to match the people reported with cancer to records in the Washington State Cancer Registry (WSCR). In 1990, the state legislature made cancer a reportable condition and established WSCR. New cases of cancer that must be reported to WSCR include "any malignant neoplasm, with the exception of basal and squamous cell carcinoma of the skin."[1] Sources of information on new cancers include reports from hospitals, pathology laboratories, radiation oncology centers, ambulatory surgical centers, cancer treatment centers, and physicians. Complete WSCR data start in 1992. This allowed us to obtain additional detail on the type of cancer, age at time of diagnosis, and the year the cancer was diagnosed. Cancers can spread to other organs. Knowing the primary site, or the organ where the cancer arose, is essential to evaluate whether a cluster of similar cancers has occurred.
- When we could not verify a reported cancer through WSCR, we requested copies of death certificates collected by the Washington State Department of Health. Death certificates include information on cause of death, year of death, age and other demographics. Death certificates sometimes do not provide details such as when the cancer was diagnosed or the type of cancer the person died from.

For our analysis, we used the information from WSCR when possible, since WSCR has the most complete, precise and accurate information on new cancer cases. However, not every cancer occurrence that was reported could be confirmed through WSCR. There are several possible reasons for this. Cancers that occurred in 2003 may not have been reported yet. Cancers that occurred before 1992, the first year for which reports of cancer occurrence are considered to be complete, would not be in WSCR. In addition, cancers to Washington State residents that are diagnosed and treated outside of Washington State do not fall under state law. However, WSCR has cooperative agreements with 38 other states and so most Washington residents diagnosed and treated in other states are included in WSCR.

When a report of cancer could not be confirmed through the WSCR, we used information from the death certificate and/or information provided by the employees to determine the type of cancer, age at diagnosis, and year of diagnosis. We have requested information on cancers that occurred prior to 1992 from the Fred Hutchinson Cancer Research Center, which has collected

[1] In 246-102 WAC, quoted by the Washington State Cancer Registry URL: http://www3.doh.wa.gov/WSCR/HTML/WSCRabout.shtm.

this information for a Puget Sound regional cancer registry since 1974. That data has not yet been provided but will be assessed when it is available. If the data provide information that will add to our interpretation or conclusions, it will be included in an addendum.

To see whether different cancers were likely to be related, we compiled a list of causes of the reported cancers (Table 1). Cancer is a collection of different diseases characterized by uncontrolled cell growth. Very few carcinogens (substances that cause cancer) cause more than one type of cancer.

Findings

Of the 18 people with cancer, 14 worked on the 6th floor. Two worked on the 3rd floor, and the work floor of two was not known. Of the 14 people with cancer who worked on the 6th floor, 12 worked only on the 6th floor, one worked on floors 4 and 6 and one worked on floor 6 and 7. This report focuses on these 14 people.

Seven of the 14 people reported with cancer were found in WSCR. Four additional people were matched to death certificates, but information on the specific type of cancer was found on only two of the certificates. (For the other two people with death certificates, we relied on employee reports for specific cancer type but used demographics from the certificate.) Information about the other three people with cancer, for which WSCR records or death certificates could not be found, is based on co-workers' report.

In general, there was good correspondence between the information in WSCR and that reported by the employees. For instance, in all but one of the seven WSCR-matched cancers, the type of cancer recorded by the WSCR matched the type of cancer reported by employees.

The 14 people had at least eight different types of cancer (Figure 1). Three people had lung cancers, three had breast cancer, two had liver cancer, and one each had leukemia or cancer of the ovary, stomach, thyroid or uterus. The type of cancer for one person could not be determined. There was not a clustering of a particular cancer type.

Ideally, we would have known the year of occurrence (indicated by year of diagnosis) for each of the cancers to look for clustering in time. However, we could not ascertain year of occurrence for four of the 14 people with cancer. For two of those people, either year of death or type of cancer was not known, so we had no information to estimate year of occurrence. The other two cancer types usually result in death in one to two years and we felt year of death was a reasonably good estimate of year of occurrence. Thus, we defined "year of occurrence" as either year of diagnosis or (if year of diagnosis was not available) year of death in our analysis of time clustering in the paragraph that follows.

Thirteen of the cancers in people who worked on the 6th floor occurred between 1983 and 2003 (Figure 2). Two cancers occurred in 2000 and 2003. This pattern did not suggest a clustering in time.

We found information on how long people had worked on the 6th floor before being diagnosed with cancer on only seven employees. The length of time on the 6th floor ranged from two to 30 years. Cancer typically takes 10 to 20 or more years to develop after exposure. At least three of the employees had worked fewer than 10 years, and two less than five years on the 6th floor before being diagnosed. Although we have chosen to leave these people in our analysis, the short

period makes it very unlikely that their cancers could have been caused by exposure to toxics on the 6th floor. It is possible that with complete information more of the people with cancer would show a similar short tenure on the 6th floor.

Age at diagnosis (or death, if age at diagnosis was not available) ranged from 53 to 67 years. The age for two people with cancer was not known. The average age was 60.0 years. Over half of the people with cancer were between 55 and 64 years old at diagnosis or death (Figure 3). This is consistent with the age-related increases in cancer risk seen in the general population (see Figure 5).

Twelve cancers (86%) occurred in females; two (14%) occurred in males. Sixty-two percent of the workers on the 6th floor are women; 38% are men. The proportion of men and women in the people with cancer was not statistically significantly different than the distribution of gender in the 6th floor population.

To see whether the number of reported cancers was excessive, we compared the number of people with cancer (termed "observed" cancers) with the number of cancers that would be normal (termed "expected" cancers) if the cancer rate on the 6th floor was the same as for King County residents overall. For the observed number of people with cancer, we used the number of people reported with cancer on the 6th floor that occurred in the last five years, from 1999 through 2003, because it is more likely that people with cancer in more recent years were noted, remembered and reported. (Including people from the last 10 years gives similar results.) To calculate the number of people expected to develop cancer from 1999 through 2003 if the rates on the 6th floor are the same as in King County, we multiplied the number of people in different age and gender groups currently working on the 6th floor by the age- and gender-specific cancer rates from King County for 1998 through 2000, the latest available data we had for King County. We obtained the current age and gender of people on the 6th floor, taken from personnel records, and after consultation with personnel assumed it has not changed substantially for the last five years.

Seven cancers were reported from 1999 to 2003. We debated whether to subtract one of the reported people with cancer from the observed count because the cancer occurred four years after the individual left county employment and the comparison group is limited to people who were King County residents at the time the cancer occurred. (Including former county residents who were diagnosed with cancer while a resident of another county or state in the calculation of the expected number would have increased the expected number.) However, because there was not complete agreement we left the seventh person in as a measure of a "worst case scenario". Thus, from 1999 to 2003, 7 cancers were observed, while 3.2 were expected (Figure 4). This was not a statistically significant difference (see Interpretation section below).

Interpretation

Overall, the pattern of types of cancer on the 6th floor is not unusual. Cancer of the breast (three people, or 21% of people with cancer on the 6th floor) is the most commonly diagnosed cancer in King County; 20% of cancers overall, and 37% of cancers in women, were breast cancer. Lung cancer (three people, or 21%) was the third most commonly diagnosed cancer (11.6% of all cancers) in King County residents. None of the lung cancers were mesotheliomas, a cancer specifically caused by exposure to asbestos. The other cancer types were not clustered, with either two people each (liver cancers) or, in the remaining types, one person each.

Although most carcinogens cause only one or two cancer types, we reviewed the known cancer causes of the types reported here to look for exposures that might have caused several different

types (Table 1). There is strong evidence linking several types of cancer to ionizing radiation (which may increase the risk of cancer of the lung, breast, stomach, and thyroid, and leukemia) and tobacco use (lung and stomach cancer and leukemia). It is extremely unlikely that an unknown ionizing radiation source (for instance, radon) exists in this area. We do not know the smoking status of the people who had lung cancer, stomach cancer or leukemia.

The age distribution of the people with cancer was not unusual. Most of the cancers occurred in people who were 55 to 64 year old, i.e., the older, working-age population. For most people, cancer is a disease of aging. For instance, in King County, the risk of getting cancer at age 55 to 59 (1028 per 100,000) is over twice the risk at age 45 to 49 (408 per 100,000) (Figure 5).

While 14 people with cancer (or, in our comparison below, 7 between 1999 and 2003) may seem like many people with cancer for one floor, it is not a large number when it comes to investigating a potential cause. Numbers this size vary randomly or by chance alone, and clusters of people with cancer in a specific place can seem to arise although the clustering is occurring simply by chance or random variation. To rule out chance as a cause of differences between the number of observed and expected cancers, we calculated the range of the number of cancers that might occur by chance alone (i.e,. the “95% confidence interval” of the number of observed cancers), and compared that to the expected number. While we found 7 observed cancers, that number could range from 2.81 to 14.42 from random variation. The number of expected cases, 3.2, is within this range (Figure 4), so the difference between the number of observed and expected cancers may be due to chance or random variation alone. (The 95% confidence interval is the scientific standard in assessing the amount of random variation in a small number.)

In summary, several factors tended to lower our concern that a common environmental toxic agent was causing cancer in employees: (1) The age, gender and total number of people with cancer was within expected limits; (2) There were several different types of cancer and the mix of types was not unusual and (3) The scientific literature does not point to a single environmental exposure that could cause these diverse types of cancers.

II. Indoor Air Quality in the King County Administration Building

Introduction

The question of the quality of the air inside the King County Administration Building has arisen in connection with concerns about cancer among employees in that building. Air quality is tested regularly in the Administration Building, either at the request of employees or because there is work being done which requires monitoring.

Ventilation System

The building's ventilation system is typical of other similar buildings. The air intake is located on the 2nd floor mezzanine at the northeast corner of the building, below street level. This location has more potential than a rooftop intake to bring in contaminants from the street, such as diesel exhaust odors, into the building. As the air enters the intake it is filtered with a Purelator High Efficiency (65%) filter to take out particulates. The outside air is then heated or cooled as necessary and mixed with a percentage of recirculated air from the building (the percentage varies with outside temperature). The building air flow and temperature are controlled locally by dual duct constant volume boxes located on each floor throughout the building. Perimeter heating radiators with hot water heat are also used. It must be emphasized that the air in the building is essentially the same on all floors, unless there is some local contaminant generation in one area that creates an exposure for the occupants in that immediate area. Since the building is office space throughout, air contamination from localized activities is minimal.

Asbestos

The Administration Building has sprayed-on fireproofing, containing 3 percent asbestos, above the ceiling tiles on all floors. On floors where remodeling has occurred, the fireproofing has been encapsulated to prevent any possibility of accidental asbestos contamination. Areas without encapsulation are still protected from exposure as long as the ceiling tiles are not disturbed by unauthorized employees. Any electrical or other work that needs to be done above the ceiling is carefully controlled by the Facilities Asbestos Crew, and air monitoring is always conducted when asbestos-related work is conducted.

Seventy laboratory reports were reviewed for asbestos testing between 1997 and 2003. None of the area samples revealed asbestos exposures above allowable limits. A summary of all asbestos area samples, including those in regulated asbestos work areas, is attached to this report.

Air Quality Monitoring

The King County Safety and Claims Management group has data from 26 air quality testing reports for the Administration Building during the past ten years. These reports include information concerning carbon dioxide, temperature, relative humidity, hydrocarbons, mold spores, dust, asbestos, and carbon monoxide. None of the reports indicate any significant problems with the building's air quality. No air quality problems that can be related to cancer have ever been identified. A summary of those air quality testing reports is attached.

Diesel Exhaust Monitoring

Employees have expressed concerns about diesel exhaust odors coming into the building. In the past, diesel exhaust was evaluated by measuring oxides of nitrogen, the odor-causing portion of

exhaust. Methods have now been developed to measure particulate components of diesel exhaust, as elemental carbon. Currently there are no legal exposure limits for diesel exhaust particulates in general occupational settings in the United States, but it is considered a potential human carcinogen. The EPA has established emissions limits for vehicles, and there are regulations for underground mining.

In order to address concerns about diesel exposures, air monitoring specifically for diesel exhaust particulate was conducted on January 26 and 27, 2004. Samples were taken both inside and outside of the King County Administration Building. No diesel exhaust particulate was found inside the building, and very low levels were found outside near the air intakes. Because of oxides of nitrogen and sulfur, which are components of diesel exhaust, the odor threshold is very low. Employees may occasionally smell these compounds inside the building, even though they are below allowable levels. A full summary of the monitoring results is attached to this report.

III. Limitations of this Report

1. Cancer clusters are reported across a wide array of conditions and circumstances, often with statistical results that are similar to the results here (i.e., a statistically non-significant increase that cannot be linked to an environmental cause). The level of proof required to draw a cause/effect relationship with environmentally caused cancers is very high, and includes known exposure to specific carcinogens prior to development of disease, statistical stability in elevations so that random variation can be ruled out as a cause (i.e., statistical significance) and the ability to rule out other lifestyle factors, such as tobacco use. This level of proof could not be achieved with an investigation of this kind unless there was extremely high risk, because the numbers of people who work on the 6th floor and people with cancer is relatively small, and because there is little or no information on the substances people may have been exposed to.

In summary, a scientific limitation of cancer cluster analysis, based on the relatively small number of cancer cases, is that it is only possible to detect a large increased risk. Thus, because an epidemiologic study of this kind cannot be used to rule out risk entirely, the results need to be considered along with the air monitoring data presented in this report.

2. We assume that all cancers that occurred in people working on the 6th floor were reported to us. We also assumed that the age and gender makeup of the 6th floor employees, which was essential in calculating the expected number of cancers, did not change markedly over the last five years. If new information is reported we will evaluate whether it would change our conclusions and revise the report if necessary.

Figure 1. Cancer Types in Workers in 6th Floor Administration Building, 1983 through 2003

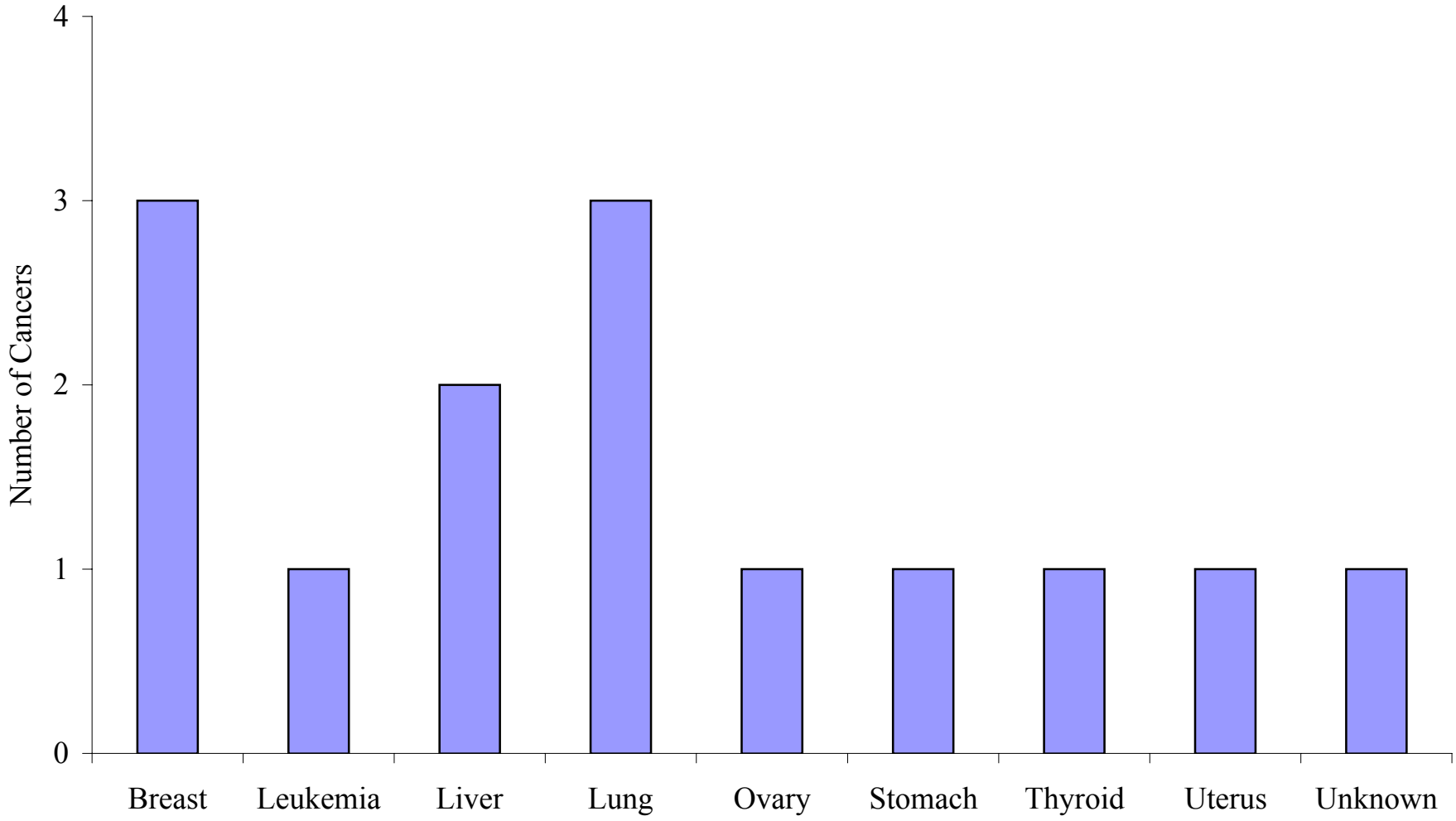

Figure 2. Year of Cancer Diagnosis or Death in Workers in 6th Floor Administration Building, 1983 through 2003

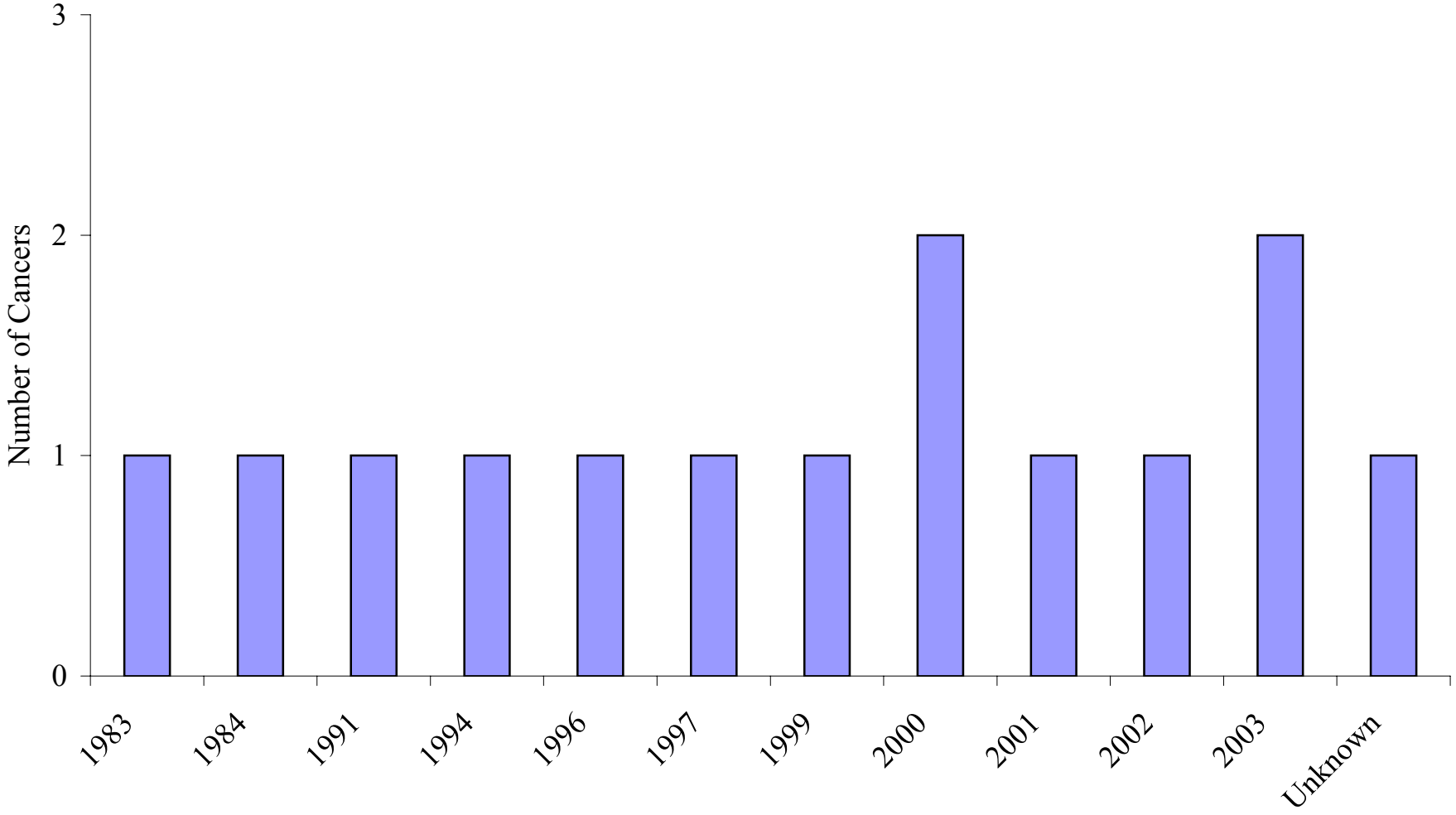

Figure 3. Age at Cancer Diagnosis or Death in Workers in 6th Floor Administration Building, 1983 through 2003

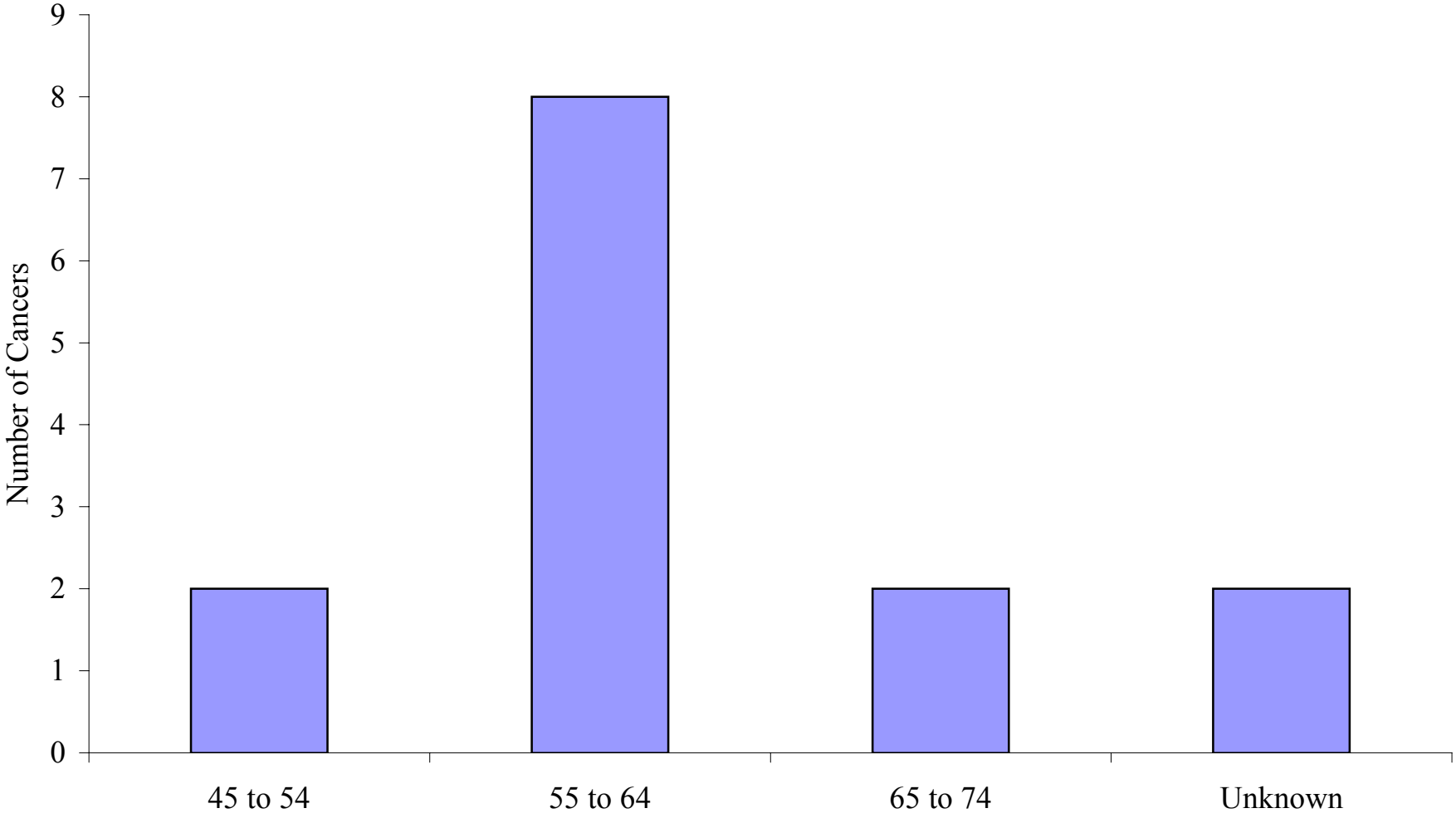

Figure 4. Number of Observed and Expected Cancers, Administration Building 6th Floor, 1999-2003

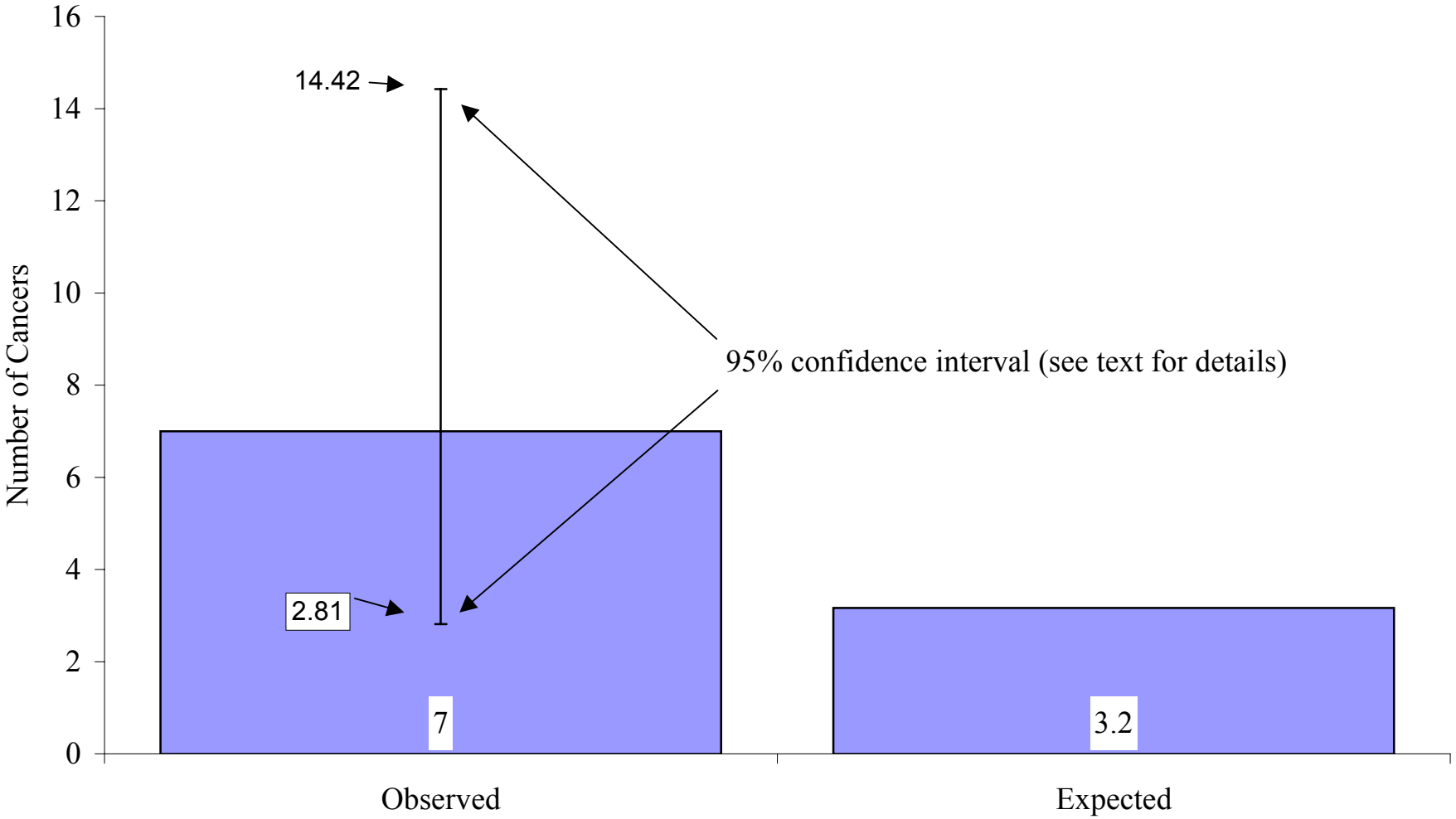

Figure 5. Cancer Incidence Rate by Age Group, King County, 3-year Average, 1998-2000

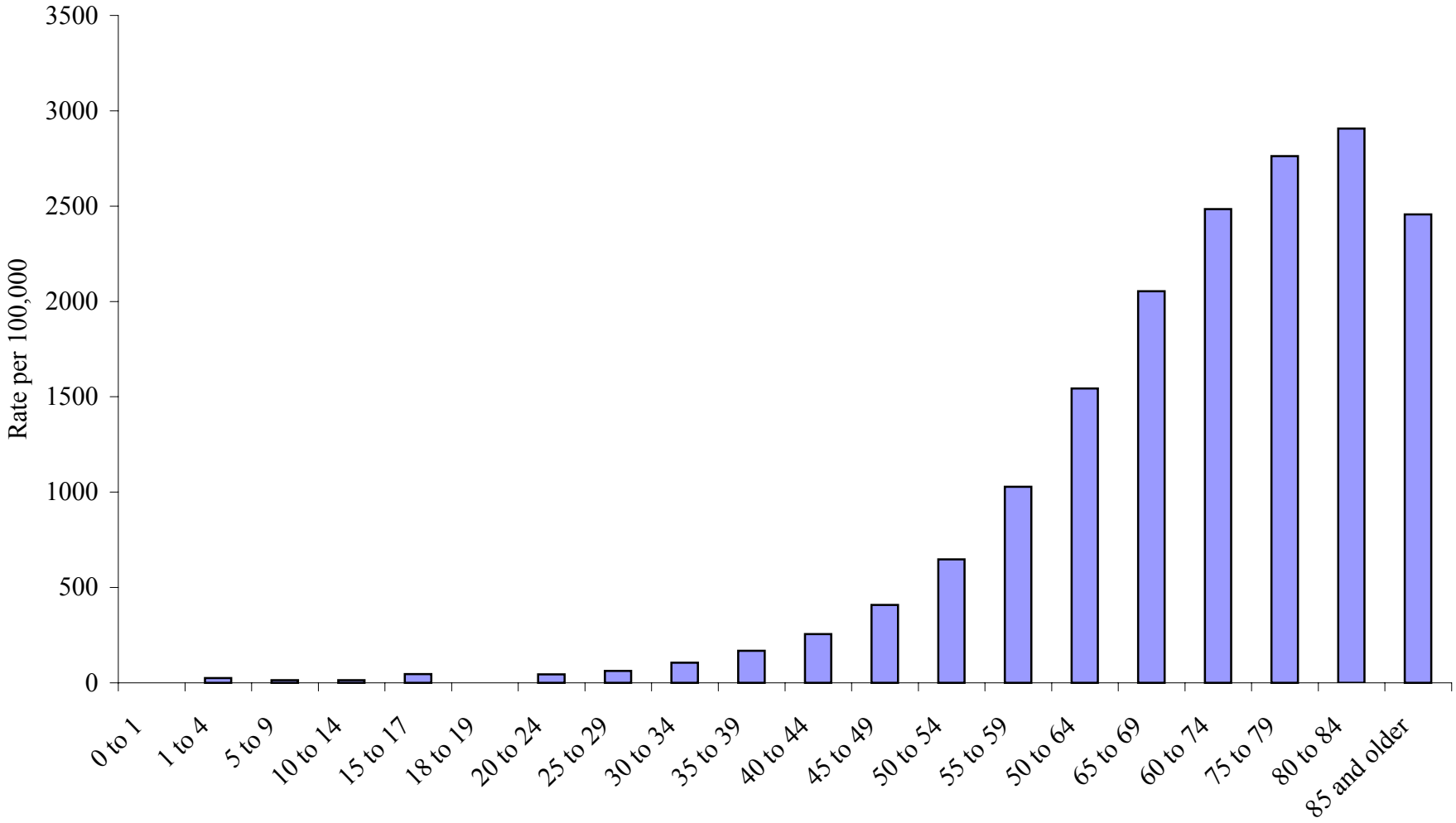

Table 1. Risk Factors for Selected Cancer Types*

Cancer Type	Age distribution	Known Risk Factors		Suggested Risk Factors
		Environmental Risk Factors	Other Risk Factors	
Lung	Low incidence under age 40, increases to age 70-75	* tobacco - modified by tar content, history of smoking, inhalation patterns, passive smoking * Ionizing radiation: Radon - mostly home exposure, not occupational * Polycylic Aromatic Hydrocarbons (PAH) - tobacco smoke and diesel motor vehicle emissions	**Genetic Susceptability:** * family history of lung cancer * gene mutation **Occupation:** * Inorganic metals, including airborne arsenic * chromate * asbestos fibers, but not fiberglass	**Diet:** * Low intake of fruits and vegetables * High intake of red or fried meats * Low intake of Vitamin E and selenium **Occupation:** - Exposure to Silica **Other:** * Air pollution * Drinking water contamination * Hormones * Limited physical activity
Breast	Low incidence under age 40, increases with increasing age	* Ionizing radiation	**Genetic Susceptability:** * family history of breast cancer * gene mutation: BRCA1 or BRCA2 * Cowden's disease * family history of ataxia-telangiectasia * Ashenazi Jew geneology **Other:** * Start of menstrual period prior to age 12 * High BMI^ * Height * Benign breast disease * Mammographically dense breasts * Age at first birth over age 30 * Menopause later than age 54 * Postmenopausal estrogen use * High estrogen levels in blood	**Diet:** * High intake of phytoestrogens (plant-based compounds similar to estrogen, such as soy) * More than one alcoholic drink per day **Other:** * Current oral contraceptive use * Limited physical activity * Limited breast feeding
Stomach	* increases with age, especially after age 55	* infection with helicobactor pylori (bacteria) * tobacco smoking (1.5-2.5x), modified by length of time smoking * ionizing radiation	**Genetic Susceptability:** * family history of stomach cancer * hereditary nonpolyposis syndrome **Occupation:** * foundry, steel, mining, metal dust exposure * farmers * rubber, leather, chemical workers **Diet:** * low fiber intake * high fat intake * consumption of pickled food * high consumption of foods with nitrites and/or nitrosamines - such as in smoked foods, salt-preserved foods, cured meats and sausages * low nitrate consumption (nitrates are found in vegetables) * PAHs in meat cooked at high temperatures	**Diet:** * reduced risk with high intake of raw vegetables, especially carrots, tomatoes, lettuce and cruciferous vegetables (broccoli, brussel sprouts, etc) * reduced risk with drinking green tea * high intake of salt **Other:** * nitrite in drinking water * gastric ulcers * correlation with Type A blood type

Cancer Type	Age distribution	Known Risk Factors		Suggested Risk Factors
		Environmental Risk Factors	Other Risk Factors	
Uterus:	* rise after menopause * peak around 65		**Genetic Susceptability:** * hereditary nonpolyposis colon cancer *polycystic ovary syndrome **Other:** * obesity/high BMI/waist-hip circumference * diabetes, especially diabetics required to take insulin to manage diabetes **Hormonal:** * having children (risk is higher in women who have never given birth) * excess estrogen in blood stream or estrogen taken without progestin	**Hormonal:** * late menopause * early onset of menstrual cycle **Other:** * hypertension * tamoxifen * vigorous physical activity
Ovary	* rare in women under age 40 * peaks in women 65-79		**Genetic Susceptability:** * family history of ovarian cancer * genetic mutation in BRCA1 or BRCA2 * hereditary nonpolyposis colon cancer **Hormonal:** * having more children (risk is highest in women who have never given birth) * oral contraceptive use **Other:** * Tubal ligation reduces risk	* family history of breast, endometrial, colon cancer * tobacco - smoking **Diet:** * high intake of animal protein, fat, and high-fat dairy products * high intake of green vegetables, fiber, carrots, and vitamin A **Hormonal:** * infertility and fertility drugs * breast feeding * post menopausal hormone use * ionizing radiation **Occupation:** * asbestos, perineal talc
Liver	* incidence increases after age 45	* aflatoxins, especially in diet * previous case of cholangiocarcinoma (cancer of the bile duct) * vinyl chloride exposure	**Genetic Susceptability:** * hemochromatosis * porphyia cutanea tarda **Infections:** * Hepatitis B or C * liver flukes **Other:** * liver cirrhosis (primarily alcoholic) * gallstones	
Acute Leukemia	* incidence of AML increases after age 40	* tobacco * ionizing radiation * benzene exposure (smoking, car exhaust, consumer products)	**Genetic Susceptability:** * family history of ataxia-telangiectasia * family history of adult AML * specific chromosomal deletions **Occupation:** * shoe, leather, rubber, nuclear workers, plastics workers * hairdressers, barbers, farmers **Other:** * infection with human T-cell leukemia/lymphoma virus 1 (HTLV-1)	**Occupation:** * exposure to nonionizing radiation Other: * exposure to diesel exhaust

Cancer Type	Age distribution	Known Risk Factors		Suggested Risk Factors
		Environmental Risk Factors	Other Risk Factors	
Thyroid	* relatively high before 40 *decreases in women after 50, still increases in men *more common in women than men (3:1)	* Radiation to the head/neck * Ionizing radiation	**Genetic Susceptability:** * Family history of thyroid cancer * Goiter, family history of goiter * multiple endocrine neoplasia	**Diet:** * high iodine intake * low intake of cruciferous vegetables
Non Hodgkin Lymphoma, B-cell variety	* NHL has been increasing in western countries * Rate increases after age 45		**Genetic Susceptability:** * Family history of Non-Hodgkin lymphoma * Family history of other blood proliferation diseases **Infection:** * EBV - Epstein Barr Virus, especially in conjunction with other immunodeficiency syndromes, such as axtaxia-telengiectasia * HIV - infection with HIV/AIDS **Other:** * Organ transplantation * Autoimmune diseases: rheumatoid arthritis, lupus, celiac disease	* Infection with Hepatitis C * Lack of physical activity * Adult onset diabetes

***The main source of information for this table is: Adami H-O, Hunter D and Trichopoulos D, Editors (2002): Textbook of Cancer Epidemiology, Oxford University Press, New York, NY.**

^(body mass index, a measure of obesity)

King County Administration Building Asbestos Area Samples 1997 - 2003

This table shows air monitoring results during and after asbestos projects in the King County Administration Building between 1997 and 2003. These results reflect area samples only, not personal monitoring results for asbestos workers.

Washington State Department of Labor and Industries requires that employees be exposed to no more than 0.1 fibers per cubic centimeter of air (fibers/cc) as an 8-hour time-weighted average, and not more than 1.0 fiber/cc over a period of 30 minutes. Post-abatement clearance samples are required to not exceed the pre-abatement fiber concentration, or 0.1 fibers/cc, whichever is lower. The EPA recommended clean air level is 0.01 fibers/cc.

The samples below show airborne fiber levels (which may include mineral wool, cellulose and glass fiber) during asbestos abatement projects. The laboratory identifies and reports all fibers falling within a specific size range, and does not differentiate between different fiber types. We conservatively assume that all fibers counts reported are asbestos.

Samples that are representative of potential office worker fiber exposures range from less than 0.001 to 0.009. All values with a "<" sign indicate fiber levels below the limit of detection. The sprayed-on material above the ceiling tiles has consistently been shown to contain only 3 to 5% chrysotile asbestos. Anything below 1% is not considered asbestos-containing material.

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
2003			
1/16/2003	9th floor by information desk	Outside work area during glove bag removal	0.004
2/3/2003	Room 709	Area sample	0.003
2/3/2003	Room 709	Area sample	0.004
2/3/2003	Room 709	Area sample	<0.002
2/3/2003	Room 709	Area sample	0.003
2/3/2003	Room 709	Area sample	<0.002
2/5/2003	Penthouse	Clearance after glove bag work	0.003
2/20/2003	7th floor N. wing	Spill area above ceiling under file cabinet	0.005
2/20/2003	7th floor N. wing	Spill area above ceiling by return air	0.006
4/15/2003	8th floor law library, east side	Area sample	<0.002
4/15/2003	8th floor law library, west side	Area sample	<0.002

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
4/15/2003	8th floor law library, SW corner office	Area sample	<0.002
4/15/2003	8th floor law library, east side	Clean up clearance sample	<0.002
4/15/2003	8th floor law library storage room	Clean up clearance sample	<0.002
4/15/2003	8th floor office, S side	Clean up clearance sample	<0.002
4/16/2003	Room 708	Work area during electrical work in ceiling plenum	0.021
4/16/2003	Room 709	Work area during electrical work in ceiling plenum	0.011
4/16/2003	Room 707	Work area during electrical work in ceiling plenum	0.029
4/16/2003	Room 708	Clearance work area	0.007
4/16/2003	Room 709	Clearance work area	0.003
4/16/2003	Room 707	Clearance work area	0.008
4/17/2003	NW 7th floor hallway	Work area during electrical work in ceiling plenum	0.018
4/17/2003	Room 800, SE side	Clearance work area	0.005
4/17/2003	NW 7th floor hallway	Clearance work area	0.009
8/4/2003	Room 602, SE corner	fallen ceiling tile, area sample	0.003
8/4/2003	Room 602, aisle way	fallen ceiling tile, area sample	0.003
8/4/2003	Room 609, SE cubicle	Post cleanup area sample	0.003
8/4/2003	Room 609, corridor outside cleaned area	Post cleanup area sample	0.003
8/14/2003	4th floor lunch room	Clearance after VAT removal	<0.004
8/14/2003	4th floor business license area	Clearance after carpet and VAT removal	0.004
10/3/2003	6th floor, NW corner	Clearance after VAT removal	<0.002
2002			
1/31/2002	8th floor pipe chase	Clearance after glove bag removal	<0.002
1/31/2002	7th floor pipe chase	Clearance	<0.002
1/31/2002	6th floor pipe chase	Clearance	0.003
2/4/20002	4th floor pipe chase, men's	Clearance after glove bag removal	<0.003
2/4/2002	4th floor pipe chase, women's	Clearance after glove bag removal	<0.003
2/4/2002	5th floor pipe chase, men's	Clearance after abatement	0.003

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
2/4/2002	5th floor pipe chase, women's	Clearance after abatement	<0.002
2/5/2002	8th floor pipe chase, men's	Clearance after glove bag removal	<0.003
2/5/2002	7th floor pipe chase, men's	Clearance after glove bag removal	<0.002
2/5/2002	6th floor pipe chase, men's	Clearance after glove bag removal	<0.002
2/8/2002	8th floor pipe chase	Clearance after encapsulation	0.002
2/8/2002	7th floor pipe chase	Clearance after encapsulation	<0.003
2/8/2002	6th floor pipe chase	Clearance after encapsulation	<0.002
2/20/2002	Room 320	Clearance after glove bag removal	<0.005
3/7/2002	Hallway be room 320	Area sample after asbestos spill, in work area	0.002
2001			
3/1/2001	Room 320, work order area	Post-earthquake, pre-cleanup	0.004
3/1/2001	8th floor Assessors office, SE corner	Post-earthquake, pre-cleanup	<0.003
3/1/2001	8th floor Assessors office, SW corner	Post-earthquake, pre-cleanup	<0.003
3/1/2001	8th floor Assessors office, center	Post-earthquake, pre-cleanup	<0.003
3/1/2001	8th floor Assessors office, north end	Post-earthquake, pre-cleanup	0.004
3/1/2001	7th floor	Post-earthquake, pre-cleanup	<0.003
3/1/2001	6th floor Holmes office	Post-earthquake, pre-cleanup	0.004
3/1/2001	6th floor SE corner	Post-earthquake, pre-cleanup	0.004
3/1/2001	6th floor middle of east side	Post-earthquake, pre-cleanup	0.004
3/1/2001	6th floor NE corner	Post-earthquake, pre-cleanup	0.006
3/1/2001	6th floor SW corner office	Post-earthquake, pre-cleanup	0.005
3/1/2001	6th floor room 620	Post-earthquake, pre-cleanup	0.003
3/1/2001	State auditor office	Post-earthquake area sample	0.004
3/1/2001	6th floor room 615	Post-earthquake area sample	0.005
3/1/2001	5th floor room 510	Post-earthquake area sample	0.003
3/1/2001	5th floor room 540	Post-earthquake area sample	0.004
3/2/2001	5th floor computer room, election office	Post-earthquake area sample	0.002
3/2/2001	5th floor work room west, election office	Post-earthquake area sample	<0.002

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
3/2/2001	5th floor work room east, election office	Post-earthquake area sample	0.003
3/2/2001	5th floor by front counter, election office	Post-earthquake area sample	0.002
3/2/2001	5th floor mid east side, election office	Post-earthquake area sample	0.004
3/2/2001	5th floor NE corner, election office	Post-earthquake area sample	0.004
3/2/2001	5th floor manager office, elections	Post-earthquake area sample	0.003
3/2/2001	7th floor SW hallway	Post-earthquake area sample	0.008
3/2/2001	7th floor mid S. end	Post-earthquake area sample	0.005
3/2/2001	7th floor SE corner office	Post-earthquake area sample	0.005
3/2/2001	7th floor E. side hallway	Post-earthquake area sample	0.006
3/2/2001	On top of elevator car	Post-earthquake area sample	0.009
3/3/2001	7th floor E. side office by wall	Post-earthquake area sample	0.002
3/3/2001	7th floor NE corner	Post-earthquake area sample	<0.002
3/3/2001	7th floor mid-N. end	Post-earthquake area sample	<0.002
3/3/2001	7th floor NW corner	Post-earthquake area sample	<0.002
7/12/2001	9th floor lobby area	Area sample during glove bagging, inside regulated area	0.003
7/12/2001	9th floor lobby area	Clearance sample after removal	0.006
7/12/2001	9th floor storage room	Area sample during glove bag removal, inside regulated area	0.004
7/12/2001	9th floor storage room	Clearance sample after removal	<0.002
11/9/2001	Inside elevator shaft	Pre abatement during abatement set up	0.006
11/10/2001	9th floor lobby inside elevator shaft #3	Clearance sample after abatement	0.004
11/12/2001	4th floor inside elevator shaft #3	Clearance sample after abatement	0.008
11/19/2001	Room 320	Pre abatement area for VAT removal	0.009
11/19/2001	Outside room 320	During VAT removal, outside work area	0.011
11/20/2001	Room 320	Clearance after VAT removal	0.002
12/10/2001	Room 320	Pre abatement during setup for ceiling tile removal, in work area	0.021
12/10/2001	Room 320	Area sample during ceiling tile removal, outside work area	0.005

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
12/10/2001	Room 320 S. window	Near HEPA exhaust	0.002
12/13/2001	Room 320 S. window	Near HEPA exhaust	0.006
12/13/2001	Room 320 by hallway	Area sample during spray sealing, outside work area	0.006
12/15/2001	Room 320 by hallway	Area sample during spray sealing, outside work area	0.004
12/15/2001	Room 320 S. window	Near HEPA exhaust during spray sealing	0.011
12/16/2001	Room 320	Clearance after asbestos abatement	<0.001
12/20/2001	Room 320	Clearance after mastic removal	0.003
12/27/2001	Room 320	Pre abatement during wall demo set-up	0.018
12/27/2001	Room 320	Clearance after wall demo	<0.002
2000			
1/3/2000	9th floor	Outside regulated area during spray encapsulation	0.004
1/3/2000	9th floor	HEPA exhaust – SW windows	<0.003
1/3/2000	9th floor	Clearance after encapsulation	0.007
1/7/2000	9th floor	Pre-abatement in regulated area	0.015
1/10/2000	9th floor	HEPA Exhaust, removing ceiling tiles	<0.002
1/10/2000	9th floor	Outside regulated area, moving ceiling tiles	0.014
1/11/2000	9th floor	Inside regulated area, removing lights and ductwork	0.026
1/11/2000	9th floor	Outside regulated area, removing lights and ductwork	0.038
1/11/2000	9th floor	Near HEPA exhaust SW window	0.004
1/18/2000	9th floor	Near HEPA exhaust S window, demo and spray sealant	0.051
1/18/2000	9th floor	Outside regulated area during demo and spray sealant	0.018
1/20/2000	9th floor	Inside regulated area during encapsulation	0.005
1/20/2000	9th floor	Near HEPA exhaust during encapsulation	<0.003
1/20/2000	9th floor	Outside regulated area during encapsulation	0.001

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
1/24/2000	9th floor	Near HEPA exhaust during encapsulation	<0.002
1/24/2000	9th floor	Outside regulated area during encapsulation	0.004
1/31/2000	9th floor	Pre-abatement inside work area	0.011
1/31/2000	9th floor	Near HEPA exhaust during ceiling tile removal	<0.003
1/31/2000	9th floor	Outside regulated area during ceiling tile removal	0.011
2/2/2000	9th floor	Inside regulated area during lights removal	0.103
2/2/2000	9th floor	Outside regulated area during lights removal	0.064
2/7/2000	9th floor	Outside regulated area during spray encapsulation	0.014
2/7/2000	9th floor	Near HEPA exhaust during spray encapsulation	0.004
2/9/2000	9th floor	Near HEPA exhaust during final coat spray	0.025
2/9/2000	9th floor	Outside regulated area during final coat spray	0.011
2/9/2000	9th floor	Clearance after encapsulation	0.005
3/1/2000	9th floor pipe chase	Clearance after glove bagging	<0.004
3/2/2000	9th floor	Clearance after demo	<0.002
3/2/2000	9th floor	Clearance after demo	<0.002
3/8/2000	9th floor HVAC	Clearance after glove bagging	<0.003
3/9/2000	9th floor NE side	Inside regulated area, glove bagging	<0.001
3/9/2000	9th floor NE side	Clearance at end of shift	<0.002
3/13/2000	9th floor SE area	Inside regulated area during glove bag – scraping	0.011
3/13/2000	9th floor SE area	Clearance at end of shift	<0.002
3/14/2000	9th floor SE area	Inside regulated area during glove bagging	<0.001
3/14/2000	9th floor S side	Clearance at end of shift	<0.002
3/15/2000	9th floor SE side	Inside regulated area during glove bagging	<0.001
3/15/2000	9th floor SE side	Clearance at end of shift	<0.003

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
3/16/2000	9th floor SE side	Inside regulated area during glove bagging	<0.001
3/16/2000	9th floor SE side	Clearance after work completed	<0.002
3/20/2000	9th floor S side	Inside regulated area during glove bagging	0.003
3/20/2000	9th floor S side	Clearance at end of shift	<0.001
3/21/2000	9th floor S side	Inside regulated area during glove bagging	0.006
3/21/2000	9th floor S side	Clearance at end of shift	<0.002
3/22/2000	9th floor SW corner	Inside regulated area during glove bagging	0.005
3/22/2000	9th floor SW corner	Clearance at end of shift	<0.002
3/23/2000	9th floor	Inside regulated area during glove bagging	0.004
3/23/2000	9th floor	Clearance at end of shift	<0.002
3/27/2000	9th floor E side	Inside regulated area during glove bagging	<0.001
3/27/2000	9th floor E side	Clearance at end of shift	<0.002
3/28/2000	9th floor W side	Inside regulated area during glove bagging	<0.001
3/28/2000	9th floor NW side	Clearance after glove bagging	<0.002
3/29/2000	9th floor N side	Inside regulated area during glove bagging	0.001
3/29/2000	9th floor N side	Clearance after glove bagging	<0.002
3/30/2000	9th floor west side lobby	Pre-abatement	0.008
3/30/2000	9th floor east side	Pre-abatement	0.006
3/30/2000	9th floor lobby area	Inside regulated area during glove bagging	<0.002
3/30/2000	9th floor lobby area	Clearance after removal completed	<0.002
4/17/2000	9th floor E side	Inside regulated area during glove bagging	0.003
4/17/2000	9th floor E side	Clearance at end of shift	<0.002
4/18/2000	9th floor	Inside regulated area during glove bagging	0.003
4/18/2000	9th floor	Clearance at end of shift	<0.002
4/19/2000	9th floor W wall	Inside regulated area during glove bagging	<0.001

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
4/19/2000	9th floor W wall	Clearance after glove bagging	<0.003
4/20/2000	9th floor N central side	Inside regulated area during glove bagging	0.004
4/20/2000	9th floor N central side	Clearance after glove bagging	<0.003
5/3/2000	9th floor SW side	Inside regulated area during glove bagging – scraping	0.002
5/3/2000	9th floor S side	Clearance at end of shift	<0.002
5/4/2000	9th floor hallway	Inside regulated area during glove bagging	<0.002
5/4/2000	9th floor hallway	Clearance after removal completed	0.002
5/15/2000	9th floor lobby	Clearance at end of shift	0.003
9/28/2000	6th floor room 653	Outside regulated area during VAT removal	<0.003
9/28/2000	6th floor room 618	Outside regulated area during VAT removal	<0.003
10/2/2000	6th floor room 615	Outside regulated area during mastic removal	<0.003
10/2/2000	6th floor room 653	Outside regulated area during mastic removal	<0.003
10/2/2000	6th floor room 620	Clearance after removal complete	<0.002
10/4/2000	8th floor E side	Pre-abatement inside enclosure, during ceiling tile removal	0.105
10/5/2000	8th floor E side	Near HEPA exhaust E windows	<0.003
10/5/2000	8th floor hallway/lobby	Outside regulated area during spray encapsulation	<0.003
10/5/2000	8th floor room 807	Outside regulated area during encapsulation	<0.003
10/5/2000	8th floor NE office	Outside regulated area during encapsulation	<0.003
10/5/2000	8th floor	Inside regulated area	<0.002
10/9/2000	8th floor lobby	Encapsulation work	<0.003
10/9/2000	8th floor room 807	Outside regulated area during encapsulation	<0.003
10/9/2000	8th floor NE offices	Outside regulated area during encapsulation	<0.002
10/11/2000	8th floor lobby	Encapsulation	0.004
10/11/2000	8th floor room 807	Outside regulated area during encapsulation	0.003
10/11/2000	8th floor NE offices	Outside regulated area during encapsulation	<0.003

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
10/11/2000	8th floor	Clearance after encapsulation	<0.002
11/1/2000	8th floor SE corner	Outside regulated area during glove bagging	0.009
11/1/2000	8th floor SE corner	Clearance after glove bagging	0.003
11/27/2000	8th floor E side	Clearance at end of shift	<0.002
11/29/2000	8th floor NE rooms	Clearance at end of shift	<0.002
1999			
4/16/1999	6th floor hallway S end	Inside regulated area, picking up loose tile	<0.013
9/28/1999	8th floor	Inside regulated area	0.007
9/28/1999	8th floor room 807E	Inside regulated area	<0.004
11/9/1999	9th floor N side	Inside regulated area during ceiling tile removal	0.018
11/10/1999	9th floor N side	Inside regulated area vacuuming lights	0.007
11/15/1999	9th floor N side	Inside regulated area vacuuming and removing lights	0.007
11/16/1999	9th floor	Inside regulated area washing lights and removing wiring	0.004
11/16/1999	9th floor	Outside regulated area washing lights and removing wiring	0.005
11/23/1999	9th floor	Pre-abatement	0.005
11/23/1999	9th floor NW	Near HEPA exhaust	0.002
11/23/1999	9th floor	Outside regulated area	<0.002
11/29/1999	9th floor	Inside regulated area during encapsulation	0.003
11/30/1999	9th floor	Clearance after encapsulation	<0.003
12/1/1999	9th floor N side	Outside regulated area during encapsulation	0.009
12/1/1999	9th floor N side	Near HEPA exhaust	<0.008
12/6/1999	9th floor	Near HEPA exhaust	<0.002
12/6/1999	9th floor	Outside regulated area during spray final coat	0.002
12/8/1999	9th floor	Inside regulated area during encapsulation	0.004
12/8/1999	9th floor	Outside regulated area during encapsulation	0.006

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
12/8/1999	9th floor SW windows	Near HEPA exhaust during encapsulation	0.019
12/13/1999	9th floor	Clearance after encapsulation	<0.002
12/13/1999	9th floor	Pre-abatement	0.002
12/15/1999	9th floor	Inside regulated area vacuuming lights	0.040
12/16/1999	9th floor	Inside regulated area during light washing	0.010
12/22/1999	9th floor	Clearance after abatement	<0.002
12/22/1999	9th floor	Outside regulated area during encapsulation with spray sealant	0.008
12/22/1999	9th floor	Near HEPA exhaust at W windows during encapsulation	<0.002
12/28/1999	9th floor	Near HEPA exhaust during encapsulation	<0.002
12/28/1999	9th floor	Outside regulated area during encapsulation	0.010
1998			
9/22/1998	1st floor room 105	Clearance after glove bag abatement	<0.002
9/24/1998	4th floor Human Resources reception	Clearance after abatement	<0.003
9/28/1998	1st floor lobby	Clearance after glove bag abatement	<0.002
9/29/1998	1st floor lobby	Clearance after glove bag abatement	<0.002
9/30/1998	1st floor lobby	Clearance after glove bag abatement	<0.003
10/1/1998	1st floor lobby	Outside regulated area during glove bagging	<0.003
10/1/1998	1st floor lobby	Clearance after glove bag abatement	<0.003
10/5/1998	1st floor lobby	Outside regulated area during glove bagging	<0.004
10/5/1998	1st floor lobby	Clearance after removal	<0.002
10/6/1998	1st floor lobby	Outside regulated area during glove bagging	<0.004
10/6/1998	1st floor lobby	Inside regulated area during glove bagging	<0.002
10/6/1998	1st floor lobby	Clearance after abatement	<0.002

DATE	LOCATION IN ADMINISTRATION BUILDING	SAMPLE DESCRIPTION	AIRBORNE LEVEL, FIBERS/cc
11/12/1998	3rd floor, room 311	Clearance after glove bag work	<0.002
12/8/1998	1st floor surplus room	Clearance after encapsulation work	<0.002
1997			
2/18/1997	8th floor, room 808C	Clearance after glove bag removal	<0.002
2/24/1997	8th floor, hallway south of room 808C	Outside regulated area during wall construction above ceiling	0.002
2/25/1997	8th floor, hallway south of 808C	Outside regulated area during wall construction above ceiling	<0.001
2/26/1997	8th floor, room 808C	Inside regulated area during construction above ceiling	<0.001
2/27/1997	8th floor room 808C	Inside regulated area during construction above ceiling	<0.002
3/1/1997	8th floor, room 808C	Pre-abatement	0.003
3/1/1997	8th floor, room 808C	Outside regulated area during encapsulation	0.005
3/2/1997	8th floor, S window room 807E	Near HEPA exhaust during encapsulation	<0.004
3/2/1997	8th floor, room 808C	Outside regulated area during encapsulation	<0.004
3/3/1997	8th floor, room 808C	Clearance after encapsulation	<0.002
10/8/1997	6th floor, room 653	Clearance after glove bag removal	<0.002
10/21/1997	9th floor NW corner	Inside regulated area, N wall	<0.001
12/13/1997	6th floor, room 618	Inside regulated area during glove bag removal	<0.007
12/13/1997	6th floor, room 618	Clearance after glove bag removal	<0.003
12/15/1997	7th floor	Pre-abatement	<0.002
12/15/1997	7th floor	Inside regulated area during carpet and VAT removal	0.003
12/16/1007	7th floor	Outside regulated area during carpet and VAT removal	<0.004
12/17/1997	7th floor	Inside regulated area during mastic removal	<0.001
12/23/1997	7th floor	Clearance after VAT and mastic removal	0.006

Administration Building Diesel Exhaust Air Monitoring Results

On January 26 and 27, 2004 air monitoring for diesel exhaust particulate was conducted inside and outside of the King County Administration Building. There are no legal exposure limits for exposure to diesel exhaust particulates in general occupational settings in the United States. However, diesel exhaust is considered a potential human carcinogen. The EPA has established emissions limits for vehicles, and there are regulations for underground mining.

The current Mine Safety and Health Administration (MSHA) standard is 0.4 milligrams per cubic meter of air (mg/m^3) total carbon, equivalent to 0.308 mg/m^3 elemental carbon. The American Conference of Governmental Industrial Hygienists (ACGIH) previously proposed a Threshold Limit Value (TLV) of 0.02 mg/m^3 for diesel exhaust, expressed as elemental carbon. This proposed TLV was withdrawn in 2003, but it is used in the table below for comparison purposes.

No elemental carbon was detected in any of the samples taken inside the Administration building. The samples taken outside were well below the former ACGIH proposed TLV.

DATE	ADMINISTRATION BUILDING LOCATION	ELEMENTAL CARBON, MICROGRAMS PER SAMPLE	ELEMENTAL CARBON, mg/m^3	FORMER ACGIH PROPOSED STANDARD, mg/m^3
1/26/2004	NE corner of 2nd floor terrace, outside near air intake	3.5	0.0028	0.02
1/26/2004	2nd floor, facilities conference room	ND	<0.0012	0.02
1/26/2004	6th floor lunchroom on top of refrigerator	ND	<0.00092	0.02
1/26/2004	6th floor conference room on window ledge above heater	No results – pump was tampered with, invalidating sample		0.02
1/27/2004	5th Avenue terrace, outside entrance to 4th floor, above air intake	3.8	0.0025	0.02
1/27/2004	NE 6th floor on file cabinet between Accounts Receivable and Financial Accounting	ND	<0.00089	0.02

ND = not detectable
(the numbers shown in the 4th column with a "<" indicate the limit of detection for those samples)

Administration Building Indoor Air Quality

Letter Log Number	Date	Building/Office	Floor	Area	C02	Temp	RH	Other (Specify)	Result	Standard	Other (Specify)	Result	Standard	Other (Specify)	Result
222/93	11/30/1993	Administration Building	9	Room 976	500-580	N/A	N/A								
202/94	4/4/1994	Administration Building (Assessments Dept)	8	Rooms 807E and 807F	450-700	70-77	24-31								
078/95	3/13/1995	Administration Building (Engineering Services)	8 and 9	Molly Robinsons Desk	450-525	71-77	18-25	CO (ppm)	0	35 ppm	Hydrocarbons (ppm)	0	50 ppm		
078/95	3/13/1995	Administration Building (Engineering Services)	8 and 9	L. Tonelli's Desk	420-650	72.8-77	15-20								
078/95	3/13/1995	Administration Building (Engineering Services)	8 and 9	S. Kohn's Desk	400-540	75.5-78	21-28								
078/95	3/13/1995	Administration Building (Engineering Services)	8 and 9	L. Bixter-Messmer's Area	420-500	66-79	27-29.5	CO (ppm)	0	35 ppm	Hydrocarbons (ppm)	0	50 ppm		
078/95	3/13/1995	Administration Building (Engineering Services)	8 and 9	Bridges and Structures Unit	450-525	68-75	29-31								
145/95	5/29/1995	Administration Building (Assessments Dept)	7	Dan Castoriano's Desk	<<800	76-80	Normal								
204/95	8/28/1995	Administration Building (Assessments Dept)	8	Appraisal Group, Lana's Desk	400-500	69.5-76	36.5-41								
204/95	8/28/1995	Administration Building (Assessments Dept)	8	C. Paula's Desk	370-530	72-77	N/A								
204/95	8/28/1995	Administration Building (Assessments Dept)	8	L. Morgan's Desk	390-460	70-76.5	N/A								

Administration Building Indoor Air Quality

Letter Log Number	Date	Building/Office	Floor	Area	C02	Temp	RH	Other (Specify)	Result	Standard	Other (Specify)	Result	Standard	Other (Specify)	Result
204/95	8/28/1995	Administration Building (Assessments Dept)	8	East Side of Commercial Section	375-540	71.4-77	32-37								
204/95	8/28/1995	Administration Building (Assessments Dept)	8	Near T. Duncan's Desk	390-580	72.5-75.8	33-36								
204/95	8/28/1995	Administration Building (Assessments Dept)	8	Printshop, Copier Room	400-640	72.5-77.8	33-37	Hydrocarbons (ppm)	0	50 ppm					
204/95	8/28/1995	Administration Building (Assessments Dept)	8	West Side of Commercial Section	390-530	71-78	N/A								
284/95	11/28/1995	Administration Building	9	CAD Room	380-520	69-78	44-60								
151/97	5/13/1997	Administration Building (Assessors Office)	7	Exemptions Area	No Quantitative Data (Chlorine Odor)										
202/01	10/2/2001	Administration Building (Assessments Dept)	7 & 8		<550	78(avg)	35-50	Air & Tapelift Samples	normal - low level glass fibers & track wear debris						
005/02	1/4/2002	Administration Building	3	Recorder's Office				Zefon® filter cassettes (mold) - before	>35 times outdoor levels		Zefon® filter cassettes (mold) - after	<1/4 of outdoor levels			
025/02	1/31/2002	Administration Building	3	Upper level records office				Zefon® filter cassettes (mold)	slightly higher than outdoor levels, but still low						
115/02	5/16/2002	Administration Building	5	Property Services-Room 500	441(avg)	75(avg)	29(avg)	Dust (mg/m3)	0.005	0.075 (EPA)	CO (ppm)	1	35 ppm (WISHA)		
138/02	6/21/2002	Administration Building	7	Public Information Area	<550	74(avg)	35-50	Dust (mg/m3)	0.006	0.075 (EPA)	Air & Tapelift Samples	normal			

Administration Building Indoor Air Quality

Letter Log Number	Date	Building/Office	Floor	Area	C02	Temp	RH	Other (Specify)	Result	Standard	Other (Specify)	Result	Standard	Other (Specify)	Result
222/02	10/31/2002	Administration Building	4	Room 450				Zefon® filter cassettes (mold)	<2.5 of outdoor levels						
017/03	1/23/2003	Administration Building	8	Department of Assessments				asbestos (fibers/cc)	not dectected						
079/03	4/3/2003	Administration Building	8	Assessor's Office				Hydrocarbons (ppm)	<0.03						
182/03	7/30/2003	Administration Building	7 & 8	Assessor's Office	<650	73-78	30-40	Toluene (ppb)	3.5	50000 (WISHA)	CO (ppm)	0-3	35 ppm (WISHA)	Hydrocarbons (ppm)	<0.03

Investigation of Reported Cancers in Workers and Air Quality Concerns -- 6th Floor, King County Administration Building (2/04)

The following are questions asked during the meetings with employees, answers to those questions, and other information about cancer clusters.

Questions on people with cancer

1. When you referred to the population age, was the age calculated at time of diagnosis or time of death?

For individuals that matched to the Washington State Cancer Registry (WSCR), it was the age of diagnosis. For other individuals who did not match WSCR, but for whom we were able to obtain death certificate information, it was the age of death. We had age at diagnosis for all but two people. These two individuals had developed cancers that were rapidly fatal, so the age at diagnosis was unlikely to be more than one or two years earlier. For these two people, we used age at death in the time cluster analysis.

2. How long had the employees worked at this location?

Data was only available for 7 employees of the 14 that worked on the 6th floor. Of the 7 individuals for whom we had data, 3 worked 10 or fewer years in that location, and 2 worked fewer than 5 years there. Science indicates that most cancers develop after a latency period of 10 or more years; that is, the cancer does not develop until after a time has passed since exposure to the carcinogen, so for those people it is extremely unlikely that a workplace exposure could have caused cancer.

3. How could stress affect cancer?

Science has not determined a definitive link between stress and cancer, though there is increasing interest in this area. Stress can be difficult to measure; what is stress for one individual may not be stressful to another. We learned that one staff member has some papers she would be willing to send over for review. In addition, we are willing to do a literature review about the topic and pass that along to interested parties.

4. What follow-up do you recommend?

Since the data does not indicate a cancer problem related to working on the 6th floor, there is not evidence to recommend specific follow-up. That being said, we recognize that some employees may have further concerns or questions and we are available to answer questions or try to address other concerns. Our contact information is on the report. Employees are also encouraged to report air quality problems to the Facilities Management Work Order Coordinator, Lani Diaz, at 206-296-0641. Air quality monitoring can be requested by calling Tim Drangsholt at 206-296-0502. Also, at the end of these FAQs we have listed some resources about investigation of cancer clusters.

5. What's the second leading type of cancer in King County?

Prostate cancer. Although there were no cases of prostate cancer reported to us in this group, that is not unusual. Prostate cancer generally occurs in older men. On the sixth floor, there was not a large number of men falling into this category.

6. **From where did the list of people with cancer come? Was it a survey of the whole building? What about the rest of the building? Do you expect to see similar results on other floors? Any attempts to identify others with cancer? Could there be a difference in individuals who came forward and those who didn't?**
   The concerned employees reported the list of individuals to us. They listed everyone they knew with cancer. We do not have cancer data on any other floors.

7. **In looking at the gender distribution of cancer, it is occurring more frequently in women out of proportion to the percent of women working on the floor. Why?**
   From the data, it is impossible to say for sure why this is so. The percentage of women who developed cancer is not statistically significantly different from the percent of women who work on the 6th floor. This means the difference may well be due to chance, or random variation, alone. Also, looking at the kinds of cancer in the women-seven different kinds in the 12 women-it is extremely unlikely that they could have been caused by a workplace risk factor or exposure.

8. **Does more cancer appear to be occurring in later years?**
   If you assume that people's memories about the last five years were perfect, looking from 1999 on, there was one cancer per year, except for 2000 and 2003, when there were two in each year. This does not appear to be a pattern. People were trying to remember co-workers who had cancer from many years ago in some instances, and people are more likely to remember more recent events.

Questions on air quality

9. **Where would they do sample testing?**
   The location of sample testing varied based on the type of sample taken. Dust testing was lifted off of desks and other furniture using tape that is then analyzed microscopically. Carbon monoxide and carbon dioxide are measured at various points in the building. Particulate matter for diesel exhaust was measured both inside and outside the building near the air intakes.

10. **Where are the air monitoring devices calibrated?**
    Air monitoring devices are calibrated before each use by King County industrial hygienists, and are calibrated and certified regularly by independent labs. All of our equipment certification is current.

11. **Asbestos monitoring does not seem to cover the earthquake that happened in February 2001. We were advised not to come into the building because asbestos levels were unsafe, but some essential employees were required to report for work anyway. It took 3 days before the asbestos level was safe enough for the remainder of employees to return to work. Where is the testing data from this period?**
    The data that was attached to the report was compiled by hand from all asbestos monitoring reports that were received for the period 1997 through 2003. None were received from that time, but we will ask again and will amend the information in the tables. The information will be updated on the web. (The asbestos monitoring data were received and reviewed, and have been added to the asbestos table. No high levels of asbestos were observed, but the building was closed so that fallen ceiling tiles could be cleaned up and structural damage could be assessed. No airborne asbestos hazard was found after the earthquake.)

12. **What should I do if I have a compromised ceiling tile?**
    Call Facilities Management Work Order Coordinator at 206-296-0641.

13. **Is it possible to eliminate the exhaust and cigarette smells that are blowing in our cubicles and offices?**
    One thing would be to move designated smoking areas away from the air intake system. During air monitoring it was noticed that a number of smokers congregated near the intakes. Unfortunately, due to the design of the building, the air intakes are on the 2nd floor mezzanine. Because some components of diesel exhaust (oxides of nitrogen and oxides of sulfur) are detectable to human noses in very low concentrations, we are able to smell diesel exhaust at levels much lower than the allowable exposure levels. Due to the design of the building's air intake system, it is not currently possible to mitigate the occasional diesel smell.

14. **Do you monitor air quality in the building year-round?**
    No, air monitoring is conducted on a request basis.

15. **When did the county start monitoring air quality?**
    In the 1980s. However, as science has progressed, more sophisticated and sensitive sampling techniques have been developed. It's now possible to measure many more substances than ever before.

16. **How long do you leave a monitor in place?**
    It varies according to the type of sampling being done. It can be anything from an instantaneous sample to a week-long sample.

17. **Could individuals experiencing the smells have a monitoring device at their cubicle to activate for an air sample when the smell happens?**
    At the current time, King County doesn't have equipment to be able to do this, but we will look into the possibility.

18. **The only successful air quality test for diesel exhaust occurred on the 6th floor in the lunch room, which is in the center of the building. Could more air quality tests happen?**
    Two successful tests for diesel exhaust particulate were taken on the 6th floor (the third was eliminated because someone turned off the sampling pump), and one sample was taken on the 2nd floor for comparison purposes. We have no reason to believe that diesel particulate is entering the building. No more diesel particulate samples are warranted, but other types of air quality monitoring can be done for general air quality analysis.

Administrative questions

19. **What is the length of sick leave on the 6th floor as it compares to others?**
    Sick leave has previously been studied in all of Finance. It is consistent with what is seen in the rest of King County. There is no significant deviation in the Unit as a whole, though management expressed a willingness to look into it again. One of the issues is how to determine the cause and effect as well as abuse of sick leave. Why are people taking sick leave?

20. Is the leave of sick leave getting longer?

Yes. But this phenomenon is not specific to the 6th floor or to Finance as a unit. The whole of King County takes longer sick leave. One explanation could be that individuals are being more consciences about taking care of themselves.

21. What does an independent review mean?

We had individuals outside King County review our procedures, analysis, and results. These individuals have experience in cancer cluster evaluation and occupational hazards.

Cancer cluster information

We recognize that the information and conclusions presented in this report may not have satisfied all staff, and the time may not have been sufficient to clearly discuss the limitations of a study of this kind. We felt information about investigations of cancer clusters might be useful, and have included the web links below from the U.S. Centers for Disease Control and Prevention (CDC), Yahoo, and universities on a variety of topics, and we will add other sites and materials as if suggestions are forwarded to us.

Unfortunately, most cancer cluster investigations do not find a cause. The CDC website recounts the national experience in investigating cancer clusters: "From 1961 to 1982, CDC investigated 108 reported cancer clusters in 29 states and 5 foreign countries in an attempt to identify a single cause of cancer; however, no clear cause was determined for any of the reported clusters. Since the mid-1980s, no CDC staff members have been dedicated to working full-time to identify and investigate cancer clusters. In June 2002, CDC's National Center for Environmental Health (NCEH) began to operate the Cancer Cluster Triaging System (CCTS), which provides responses to the public's inquiries about cancer clusters. CCTS is a joint effort of NCEH, CDC's Cancer Prevention and Control Program, CDC's National Institute for Occupational Safety and Health, and the Agency for Toxic Substances and Disease Registry."

External websites on cancer cluster investigations

- www.cdc.gov/nceh/clusters/default.htm
- www.cdc.gov/nceh/clusters/faq.htm
- www.cdc.gov/nceh/clusters/Fallon/default.htm
- www.doh.wa.gov/EHSPHL/Epidemiology/NICE/publications/ClusterProt.pdf
- http://dir.yahoo.com/Health/Diseases_and_Conditions/Cancers/Cancer_Clusters
- www.health.state.ny.us/nysdoh/environ/lovecan.htm
- www.health.state.ny.us/nysdoh/lcanal/lcanal.htm

External websites on general information about cancer and the connection between stress and cancer

General information on cancer:

What You Need to Know about Cancer
Cancer Facts
Understanding Cancer
Children's Environmental Health Project

Overview of Cancer News and Information/Resources from the National Institutes of Health (NIH) Medline Plus

Psychological stress and cancer:

- On stress: www.4woman.gov/faq/stress.htm (National Women's Health Information Center)
- On stress and cancer: http://cancerweb.ncl.ac.uk/cancernet/600317.html (NCI)